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was reached. Nevertheless, a large audience of chemists was interested and instructed by the discussion, and chemistry was benefited.

It would lead too far to attempt to give an account of all that Wurtz has done for chemistry. In addition to the epoch-making contributions mentioned, his synthesis of neurine, his methods for the synthesis of hydrocarbons and of the acids of carbon, his method for the transformation of sulphuric acids into phenols, and investigations on the condensation of aldehydes, are all worthy of much more than ordinary mention. He has also been a prolific writer of excellent books on chemistry, some of which are recognized as standards; and he has been an editor of journals of chemistry, his name being found at present on the title-pages of the *Annales de chimie et de physique* and the *Bulletin de la Société chimique*. The titles of his principal books are included in the following list: Sur l'insalubrité des résidus provenant des distilleries, 1859; Leçons de philosophie chimique, 1864; Traité élémentaire de chimie médicale, 1864–65; Leçons élémentaires de chimie moderne, 1866–68; the Dictionnaire de chimie pure et appliquée, which appeared in parts, beginning in 1868; Traité de chimie biologique, vol. i., 1880; and The atomic theory, one of the volumes of the International scientific series. His Elements of chemistry has been translated into English, and has reached a second edition in this country. His writings are clear, vigorous, and interesting. His fairness as a historian has been questioned; and it must be conceded that his enthusiasm occasionally led him to what calmer men are inclined to regard as incorrect judgment, expressed in strong language. One of his remarks, which naturally aroused the ire of the Germans, is the much-quoted phrase with which he introduced his dictionary: "La chimie est une science française: elle fut constituée par Lavoisier, d'immortelle mémoire."

In 1865, on the recommendation of the Academy of sciences, Wurtz was awarded the imperial biennial prize of twenty thousand francs. In 1867 he succeeded Pérouze as a member of the chemical section of the Academy of sciences. In 1878 he received the Faraday medal from the Royal society of England, on the occasion of his being invited to deliver the Faraday lecture before the English chemical society. In 1881 he was honored with an appointment as senator for life in the French senate.

Imperfect as this sketch is, it will at least serve to show that Wurtz occupied a commanding position among chemists of the present.

His loss is a serious blow to science, and especially to the progress of chemistry in France. It will be hard to find a successor possessing his energy and ability. Dumas died a month ago, after having reached a good old age, and after he had ceased to work actively; and while, now that he is gone, we more clearly recognize his greatness, we can nevertheless more readily reconcile ourselves to his loss than to that of Wurtz, who seemed still to belong to the younger generation, capable of guiding others for years to come, and of adding to his former brilliant discoveries.

#### RESULTS OF DREDGINGS IN THE GULF-STREAM REGION BY THE U. S. FISH-COMMISSION.<sup>1</sup>

##### 6. Evidences of the existence of light at great depths in the sea.

THE evidences of the presence of light and its quality and source at great depths are of much interest. At present very little experimental knowledge in regard to these questions is available. That light of some kind, and in considerable amount, actually exists at depths below two thousand fathoms, may be regarded as certain. This is shown by the presence of well-developed eyes in most of the fishes, all of the cephalopods, most of the decapod Crustacea, and in some species of other groups. In many of these animals, living in two thousand to three thousand fathoms, and even deeper than that, the eyes are relatively larger than in the allied shallow-water species; in others the eyes differ little, if any, in size and appearance, from the eyes of corresponding shallow-water forms; in certain other cases, especially among the lower tribes, the eyes are either rudimentary or wanting in groups of which the shallow-water representatives have eyes of some sort. This last condition is notable among the deep-water gastropods, which are mostly blind: but many of these are probably burrowing species; and it may be that the prevalent extreme softness of the ooze of the bottom, and the general burrowing habits, are connected directly with the absence or rudimentary condition of the eyes in many species belonging to different classes, including Crustacea and fishes. Such blind species usually have highly developed tactile organs to compensate for lack of vision.

Other important facts bearing directly, not only on the *existence*, but on the *quality*, of the light, are those connected with the coloration

<sup>1</sup> See *Science*, Nos. 16, 19, 27.

of the deep-sea species. In general, it may be said that a large proportion of the deep-sea animals are highly colored, and that their colors are certainly protective. Certain species, belonging to different groups, have pale colors, or are translucent, while many agree in color with the mud and ooze of the bottom; but some, especially among the fishes, are very dark, or even almost black; most of these are probably instances of adaptations for protection from enemies, or concealment from prey. But more striking instances are to be found among the numerous brightly colored species belonging to the echinoderms, decapod Crustacea, cephalopods, annelids, and Anthozoa. In all these groups, species occur which are as highly colored as their shallow-water allies, or even more so. But it is remarkable that in the deep-sea animals the bright colors are almost always shades of orange and orange-red, occasionally brownish red, purple, and purplish red. Clear yellow, and all shades of green and blue colors, are rarely, if ever, met with. These facts indicate that the deep sea is illuminated only by the sea-green sunlight that has passed through a vast stratum of water, and therefore lost all the red and orange rays by absorption. The transmitted rays of light could not be reflected by the animals referred to, and therefore they would be rendered invisible. Their bright colors can only become visible when they are brought up into the white sunlight. These bright colors are therefore just as much protective as the dull and black colors of other species.

The deep-sea star-fishes are nearly all orange, orange-red, or scarlet, even down to three thousand fathoms. The larger ophiurans are generally orange, orange-yellow, or yellowish white; the burrowing forms being usually whitish or mud-colored, while the numerous species that live clinging to the branches of gorgonians, and to the stems of Pennatulaceae, are generally orange, scarlet, or red, like the corals to which they cling. Among such species are Astrochela Lymani, abundant on the bushy orange gorgonian coral, Acanella Normani, often in company with several other orange ophiurans belonging to Ophiacantha, etc. Astronyx Loveeni and other species are common on Pennatulaceae, and agree very perfectly in color with them. These, and numerous others that might be named, are instances of the special adaptations of colors and habits of commensals for the benefit of one or both. Many of the large and very abundant Actinia, or sea-anemones, are bright orange, red, scarlet, or rosy in their colors, and are often elegantly variegated and striped,

quite as brilliantly as the shallow-water forms; and the same is true of the large and elegant cup-corals, Flabellum Goodei, *F. angulare*, and *Caryophyllia communis*,—all of which are strictly deep-sea species, and have bright orange and red animals when living. The gorgonian corals of many species, and the numerous sea-pens and sea-feathers (Pennatulaceae), which are large and abundant in the deep sea, are nearly all bright colored when living, and either orange or red. All these Anthozoa are furnished with powerful stinging-organs for offence and defence; so that their colors cannot well be for mere protection against enemies, for even the most ravenous fishes seldom disturb them. It is probable, therefore, that their invisible colors may be of use by concealing them from their prey, which must actually come in contact with these nearly stationary animals, in order to be caught. But there is a large species of scale-covered annelid (*Polynoë aurantiaca* Verr.) which lives habitually as a commensal on *Bolocera Tuediae*, a very large orange or red actinian, with unusually powerful stinging-organs. Doubtless the worm finds, on this account, perfect protection against fishes and other enemies. This annelid is of the same intense orange color as its actinian host. Such a color is very unusual among annelids of this group, and in this case we must regard it as evidently protective and adaptive in a very complex manner.

It has been urged by several writers, that the light in the deep sea is derived from the phosphorescence of the animals themselves. It is true that many of the deep-sea Anthozoa, hydroids, ophiurans, and fishes are phosphorescent; and very likely this property is possessed by members of other groups in which it has not been observed. But, so far as known, phosphorescence is chiefly developed in consequence of nervous excitement or irritation, and is evidently chiefly of use as a means of defence against enemies. It is possessed by so many Anthozoa and acalephs which have, at the same time, stinging-organs, that it would seem as if fishes had learned to instinctively avoid all phosphorescent animals. Consequently it has become possible for animals otherwise defenceless to obtain protection by acquiring this property. It is well known to fishermen that fishes avoid nets, and cannot be caught in them if phosphorescent jelly-fishes become entangled in the meshes: therefore it can hardly be possible that there can be an amount of phosphorescent light, regularly and constantly evolved by the few deep-sea animals having

this power, sufficient to cause any general illumination, or powerful enough to have influenced, over the whole ocean, the evolution of complex eyes, brilliant and complex protective colors, and complex commensal adaptations.

It seems to me probable that more or less sunlight does actually penetrate to the greatest depths of the ocean in the form of a soft sea-green light, perhaps at two thousand to three thousand fathoms equal in intensity to our partially moonlight nights, and possibly at the greatest depths equal only to starlight. It must be remembered that in the deep sea, far from land, the water is far more transparent than near the coast. A. E. VERRILL.

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#### ALPHONSE LAVALLÉE.

DENDROLOGICAL science has met with a great, an almost irreparable loss, in the death of Alphonse Lavallée, the best-known and most successful student and collector of trees of this generation. Twenty-five years ago, under the advice and inspiration of Decaisne, he commenced to gather upon his estate at Segrez, near Paris, the collection of trees and shrubs which has since developed into the richest and most complete arboretum ever established.

Mr. Lavallée did not confine himself merely to the collection and cultivation of trees: he studied them thoroughly and critically, publishing from time to time the results of his investigations.

The nomenclature and synonymy of the forms and varieties of many genera of trees cultivated in the different countries of Europe, long ago fell into an almost hopeless confusion; and, to bring some order out of this confusion, Mr. Lavallée set himself resolutely to work. The results of these investigations were published, ten years ago, in the catalogue of his collections. A second and greatly enlarged edition of this useful work, written with a riper judgment and fuller knowledge, in many critical questions of synonymy, was nearly ready for the printer at the time of Mr. Lavallée's death. He had commenced, too, the publication of the *Arboretum Segreziannum*, of which, however, only five parts had appeared. This sumptuous work, superbly illustrated with figures engraved from steel, contained the descriptions and history of some of the rarest or least-known plants of Mr. Lavallée's collections. His latest published work, a magnificently illustrated folio in which are described *Les clématites à grandes fleurs*, has only just

reached the author's correspondents in this country. This was to be followed, in the course of the year, by an illustrated monograph of the genus *Crataegus*, which has long occupied Mr. Lavallée's attention. His collection of different forms of the species of this most difficult and perplexing genus was unsurpassed, and his opportunities for observing them in a living state unequalled; so that a valuable revision of this genus might have been looked for from his pen.

Mr. Lavallée, at the time of his death, was president of the Central horticultural society of France, and perpetual treasurer of the National agricultural society, and had just declined the professorship in the Museum d'histoire naturelle, lately made vacant by the death of his old master, Decaisne. He had been in ill health for several months, but his death was entirely unexpected. It was caused by aneurism, and occurred at Segrez upon the 3d of May, only a few hours after his return from a long residence in the south of France. Mr. Lavallée was only forty-nine years old at the time of his death.

C. S. S.

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#### BURIAL-MASKS OF THE ANCIENT PERUVIANS.

A RECENT contribution to the Bureau of ethnology illustrates one of the most curious of ancient burial customs. It is almost a universal practice with primitive peoples to deposit articles of value with the dead. The ancient Peruvians were most lavish in this respect. Food, raiment, implements, utensils, rich tapestries, and precious articles of silver and gold, as well as objects of superstitious regard, were freely sacrificed.

Most interesting of all these offerings were the mask-like heads generally placed within the outer wrappings upon the top of the mummy pack. At Ancon these objects were usually made of cotton cloth. A small square sack or pillow was made, and stuffed with leaves or seaweed. One side was painted to represent the human face, and to this a wooden nose was stitched. Hair was attached to the back of the head, and a more or less elaborate head-dress was placed upon the crown.

The specimen referred to is of this class. It was obtained from a grave in the vicinity of Lima, and purchased by G. H. Hurlbut of Chicago. It differs greatly from Ancon specimens, but is somewhat similar to an example illustrated by Squier, also from the vicinity of Lima. It is interesting chiefly on account of the heter-